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ABSTRACT

The GENET (gene + net) Forum was designed as a contribution to help teachers and pupils to develop critical thinking, creativity, and values capable of assuring to future citizens an active and responsible involvement in societal evolution. This project (which includes a chat and online discussion forum) explores the ethical, legal, and social implications associated with biotechnology and genetics advances and aims to be a discussion catalyst. It is a place where European students and teachers can compare their opinions with those of their peers through tne Internet. Some controversial issues related with biotechnology innovations are discussed. The forum asks all participants to give their opinions and/or discuss others' opinions (in Portuguese, Spanish, French, or English). This paper presents and discusses the results, potentialities, and difficulties of GENET's implementation. (Author/MM)

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## TITLE

The Genet Project - The Discussion of Biotechnology and Genetics Controversies at Internet

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## ABSTRACT

The GENET Forum was designed as a contribution to help teachers and pupils to develop critical thinking, creativity and values capable of assuring, to future citizens, an active and responsible involvement in society evolution. This project (which includes a chat and an on-line discussion forum) explores the ethical, legal and social implications associated with biotechnology and genetics advances and aims to be a discussion catalyst: a place where European students and teachers can compare their opinions with those of their peers through *Internet*. Some controversial issues related with biotechnology innovations are submitted to discussion. We ask all participants to give their opinions and/or to discuss others' opinions (in Portuguese, Spanish, French or English).

This paper presents and discusses the results, potentialities and difficulties of GENET's implementation.



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# INTRODUCTION

We live in a polemical Society, marked by controversial scientific and technological developments and characterized by social tensions: tensions between individual rights and social aims, political priorities and environmental values, economic interests and health concerns. Biotechnology occupies a special place among the most polemical technologies.

This field suffered a tremendous revolution during the 80s, with the development of the DNA recombination technology that allows the combination of genetic sequences from different living organisms. The techniques of recombination of genetic material and the growing knowledge of the functions of genes in various living organisms, including man, cause hope and fear at the same time: hope for the possibility of countless applications in agriculture and in cattle breeding and in the eventual cure of hundreds diseases with genetic origins; fear of eventual environmental disasters caused by the uncontrolled proliferation of genetically altered living organisms or of a hypothetical abusive manipulation of Man's genetic patrimony by dictators and by unscrupulous oligarchies.

Many of the decisions to be made in this field regard future generations. Therefore it is essential that the whole population be informed about new breakthroughs in the area of Biotechnology, particularly in the field of Genetic Technology, so as to be able to participate in a decision process that concerns everyone. This is the context in which the GENET Project arises.

The main aim of the GENET (gene + net) Project is to motivate towards the use of the Internet as a vehicle for debate/discussion with potentialities in the growth of scientific literacy and in citizenship education through the construction and understanding of relevant knowledge for life as well as the promotion of citizens' thinking. Over two years, GENET was responsible for two initiatives seeking to promote discussion/reflection about the controversial issues related to certain recent breakthroughs in the fields of Biotechnology and Genetics:

1- An online debate (chat) involving the simultaneous participation, via Internet, of several groups of students from different Portuguese high schools;
2- The creation of an online discussion forum open to the participation of teachers and students from any subject area (this initiative is still under way).

## THE ONLINE DEBATE (CHAT)

The online debate involved 9 groups of students from four high schools, each accompanied by a teacher. Motivation for the debate was secured through a text that was previously sent for discussion in the classes of each of the participating groups. Therefore these texts were discussed both in Natural Sciences classes and in Religion and Moral classes (the subject fields of the teachers who wished to participate).

On the day and time scheduled, all the groups had the opportunity to learn and discuss the opinions of the different groups about the matters that had been previously discussed, under the supervision of a coordinator (the project coordinator). For an hour and a half we "clicked" a great deal!

## THE GENET FORUM

This project intends to be a catalyst for reflection and discussion: a space where students and teachers from all over Europe may state, compare and discuss their opinions regarding controversial issues brought on by new breakthroughs in the field of Biotechnology.

From time to time a different controversial situation is proposed for discussion. In order to allow the participation of teachers and students from other countries, the site of the forum is written in Portuguese and English. Access to one of the versions is through a simple click on the corresponding flag.

The forum is made up of several sections. Besides the section where the controversial situations and the issues for discussion are placed, there are others where participants may: a) learn about the aims of the forum; b) be offered various suggestions of activities for the use of the forum in the classroom; c) have access to a glossary of the scientific terms that are used; d) establish contact with other sites in the Internet with relevant information about the matters being discussed; and e) comment on the creation and procedure of the forum.

There are several ways to use the forum at school:

1- The texts and situations for discussion that are presented in the GENET pages may be used as ground material for group investigations. Each group may: (1) investigate one of the topics; (2) present its conclusions/opinions to colleagues; and (3) launch its conclusions on the pages of the GENET Forum, in the Internet, for a wider discussion with other participants.

2- The GENET Forum is a great opportunity for interdisciplinary projects since it is relevant to several subjects in Secondary Teaching. In English class the countless texts written in English in the Internet that GENET suggests for consultation can be translated, analyzed and discussed. The deep but fascinating dilemmas alongside the feats of Biotechnology can be discussed in Portuguese or Foreign Language classes as well as in Catholic Religion and Moral classes. The discussion activities of controversial matters presented in the GENET are also good starting points for approaching the topics "Values" or "Ethics" in the subject of Philosophy. In the Natural Sciences subjects the scientific grounds of the issues that are presented may be discussed as well as their eventual environmental, social and cultural impact.

Regardless of the choice, students are intended to launch their opinions about controversial situations presented in the GENET, in the forum pages in the Internet.

## SOME RESULTS

The initiatives undertaken so far in the context of the GENET have had positive but somewhat different results.

### The debate (Chat)

The first initiative, the debate, had a lot of interested and lively participation. The enormous potential of discussing controversial issues was also confirmed in the students' motivation and in the promotion of interaction between the numerous participants. Several proposed topics were discussed both by the coordinator and the participants:

a) The control of scientific research;

b) Releasing genetically altered living organisms into the environment;

c) The intake of genetically altered products;

d) The potentialities and limits of cloning living organisms;

e) The use of embryos in scientific research.

At the end, the participants' comments reflected how positive the debate had been (for allowing the discussion of ideas/opinions and the in-depth analysis of certain matters) but somewhat confusing, quick and superficial (due to the large number of groups related to the great desire of students to participate):

*Group B - It was quite positive and productive, but a little confusing and tiring, particularly at the start. It was also very exciting!*

*Group E - We can find out what others think about such important matters like the advance and implications of genetic science. A lot of dispersion on the topics, not many concrete things were said.*

*Group N - Positive: develop, debate, improve our knowledge in depth and our doubts regarding this topic; Negative: the incorrect intervention of certain participants.*

*Group S - We think it was good ... but there was some confusion. We're still at the beginning. The 1st time is always + difficult.*

*Group A - a) There was idea interaction; b) In a way it was a little confusing; c) Deeper analysis of ideas is essential for a debate to be good.*

*Group C - The debate was a little quick, next time it should be slower. Often we didn't have time to answer or read the questions.*

*Group D - It's always good to discuss these issues and question the values involved in them. But the internet is total anarchy and sometimes it's a little confusing. The topic was looked into a bit superficially.*

These results suggested the need to direct the GENET Project towards initiatives that promote a more organized participation and more reflection upon the issues in debate. So we embarked on the creation of the discussion forum.

## The discussion forum

Despite the dissemination that has been directed at teachers (by means of brochures and meetings) and the interest it has aroused in many of them (revealed through first-hand comments and letters addressed to the project coordinator), participation in the forum has been less than expected. With a number of interviews we found that in spite of admitting the GENET's interest and importance, teachers hardly resort to the Internet in their classes: (1) due to lack of knowledge about computers; (2) because it is simpler to do things the way they always have; (3) because they do not wish to make any "diversion" regarding the curriculum that might jeopardize its fulfillment; and/or (4) because they have difficulty in applying technological knowledge about the use of the Internet in the classroom.

Throughout one year there were 47 participations in the forum (2 individual and 45 groups with 2 to 5 elements). These were distributed between the two topics — diagnosis of genetic changes and genetic engineering — and the 5 controversial situations under discussion.

Participants' conceptions regarding the proposed topics

The texts produced show the participants' conceptions regarding the proposed topics. In this paper we shall only present the conceptions about genetic engineering on living organisms as an example.

Most of the twelve texts presented on the potentialities and limitations of genetic engineering on plants refer to the existence of pros and cons to its use (66,7%) and the need to be performed in a controlled manner (58,3%) (Table 1).

Table 1 - *Comments/Feelings about Genetic Engineering on Plants*

| Statements | n (%) |
|---|---|
| There are pros and cons to its use | 8 (66,7%) |
| Should be performed in a controlled manner | 7 (58,3%) |
| Impact on the ecosystems must be assessed | 2 (16,7%) |
| A great discovery of science | 2 (16,7%) |
| Dangers greater than benefits | 1 (8,3%) |
| Who enforces limits on research? | 1 (8,3%) |
| Man has no right to manipulate another living organism | 1 (8,3%) |

The main benefits they highlight are: a) the increase in plant production (50,0%); b) the improvement of vegetable species (33,3%); and c) the reduction of hunger in the World (25,0%) (Table 2).

Table 2 - *Benefits of Genetic Engineering on Plants*

| Statements | n (%) |
|---|---|
| Increase in plant production | 6 (50,0%) |
| Improvement of vegetable species | 4 (33,3%) |
| Reduction of hunger in the World | 3 (25,0%) |
| Increase in the quality of food | 1 (8,3%) |
| Reduction of the use of fertilizers | 1 (8,3%) |
| The survival of certain species | 1 (8,3%) |
| Answer for environmental problems | 1 (8,3%) |
| Fight against plagues | 1 (8,3%) |

Among other aspects, some of these participants worry about: a) possible unbalances in the ecosystems (25,0%); b) the damages to the food chain (25,0%); and c) the reduction of biodiversity (25,0%) (Table 3).

Table 3 - *Problems concerning Genetic Engineering on Plants*

| Statements | n (%) |
|---|---|
| Unbalances in the ecosystems | 3 (25,0%) |
| Damages to the food chain | 3 (25,0%) |
| Reduction of biodiversity | 3 (25,0%) |
| Reduction of food quality | 2 (16,7%) |
| Lack of studies about the impact on the environment | 1 (8,3%) |
| May be hazardous to public health | 1 (8,3%) |
| Change in eating and cultural habits | 1 (8,3%) |

The majority of the 15 texts presented on the potentialities and limitations of genetic engineering on human beings are totally opposed to an eventual alteration of the human species (73,3%)(Table 4). Several texts refer the need for more research and reflection in this field (41,7%). Some passionately stress the refusal of a chance to choose features of their own children (20,0%) and classify the genetic alteration of the human genome as being artificial and against nature (20,0%)(Table 4).

Table 4 - Comments/Feelings about Genetic Engineering on Human Beings

| Statements | n (%) |
|---|---|
| Man should not be redesigned | 11 (73,3%) |
| Need for more research and discussion | 5 (41,7%) |
| Would never accept to choose features of own child | 3 (20,0%) |
| Artificial and against nature | 3 (20,0%) |
| De-humanizing | 2 (13,3%) |
| Despotic | 1 (6,7%) |
| Admittedly might choose certain features that would improve own child's quality of life | 1 (6,7%) |
| Selfish | 1 (6,7%) |
| Discriminatory | 1 (6,7%) |
| Oppressive | 1 (6,7%) |

The only benefit they emphasize of applying genetic engineering to human beings is the detection and elimination of genetic diseases (53,3%)(Table 5).

Table 5 - *Benefits of Genetic Engineering on Human Beings*

| Statements | n (%) |
|---|---|
| Detection and eradication of genetic diseases | 8 (53,3%) |
| Discovery of new medicines and therapies | 2 (13,3%) |
| Better knowledge of our capacities and limitations | 1 (6,7%) |

Some of these participants feel that this technology interferes with values and human rights (20,0%) and may: a) affect the natural selection of the human species, possibly placing its survival at risk (20,0%); and b) allow the manipulation and enslavement of human beings by unscrupulous groups (20,0%)(Table 6).

Table 6 - *Problems concerning Genetic Engineering on Human Beings*

| Statements | n (%) |
|---|---|
| Damages natural selection of human species, possibly placing its survival at risk | 3 (20,0%) |
| Manipulation and enslavement of human beings | 3 (20,0%) |
| Interference with values and human rights | 3 (20,0%) |
| Unbalances of the organism | 2 (13,3%) |
| Reduction of genetic variability | 2 (13,3%) |
| Difficulty in selecting the anomalies that should be corrected | 2 (13,3%) |

Participants' opinions regarding the forum

The participants' comments regarding forum's conception and procedure have been quite positive. The 10 comments focused mainly on the interest of the forum (50,0%), its relevance for citizens (30,0%) and its present-day relevance (30,0%).

Table 7 - *Comments regarding the Conception and Procedure of the Forum*

| Statements | n (%) |
|---|---|
| Very interesting / Interesting | 5 (50,0%) |
| Relevant for citizens | 3 (30,0%) |
| Current/Timely | 3 (30,0%) |
| I really liked it | 2 (20,0%) |
| Matters worthy of debate/discussion | 2 (20,0%) |
| Controversial matters | 2 (20,0%) |
| Frightening matters | 2 (20,0%) |

## SOME FINAL REMARKS

The results achieved so far with the GENET Project reveal the Internet's great potential in promoting interaction between citizens. There was a clear educational element in the activities undertaken in promoting thinking through the discussion of relevant matters for life — the implications of the new advances in the fields of Biotechnology and Genetics and their interrelations with Society. Joint analysis of different points of view facilitated the exchange of information, the discussion of ideas/opinions and the construction of knowledge about the topics under discussion. It also gave way to the discussion of ethical issues related to these topics and the subsequent evaluation/re-elaboration of opinions and beliefs.

However, the success of school projects that associate subject contents with information and communication technologies depends decisively on the teachers. Teachers must develop their knowledge in this field so as to be able to incorporate the information and communication technologies in their classes and take advantage of their students' knowledge in using these technologies.

Currently, we are aiming for a greater involvement of teachers and students in this project. We have already planned dissemination sessions in schools that involve the discussion of the topics brought up in the GENET, with teachers and students, followed by the use of computers to launch their

conclusions in the forum pages in the Internet. We hope this practical dissemination attracts more participants.

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